

WHAT IS CLAIMED IS:

1. A piezoelectric type electroacoustic transducer comprising:
  - a piezoelectric vibrating plate including a plurality of piezoelectric ceramic layers laminated to each other with an internal electrode interposed between each of the plurality of piezoelectric ceramic layers, and main surface electrodes provided on front and back side main surfaces of the piezoelectric vibrating plate, whereby the piezoelectric vibrating plate is surface-flexural-vibrated in a thickness direction thereof with an AC signal applied between the main surface electrodes and the internal electrode; and
    - a box including supporting portions on which the outer peripheral portions of the back side of the piezoelectric vibrating plate is supported, the piezoelectric vibrating plate having a protecting film provided on substantially the entire back side surface or on the front and back side surfaces of the piezoelectric vibrating plate, the protecting film being formed by applying a paste resin in a film-shape and hardening the resin, or by bonding an adhesive sheet and hardening the sheet, and the piezoelectric vibrating plate is warped on the front-side thereof by the hardening shrink stresses of the protecting films.
2. A piezoelectric type electroacoustic transducer according to Claim 1, wherein the protecting films are provided on both of the front and back side surfaces of the piezoelectric vibrating plate, and the protecting film on the back side surface has thickness that is greater than the protecting film on the front side surface.
3. A piezoelectric type electroacoustic transducer according to Claim 1, wherein the piezoelectric vibrating plate has a substantially rectangular shape, and the supporting portions of the box are provided in four positions in the inner peripheral portion of the box so as to support four corners of the piezoelectric vibrating plate.
4. A piezoelectric type electroacoustic transducer according to Claim 1, further comprising end surface electrodes provided on end surfaces of said piezoelectric

vibrating plate, wherein said internal electrode is electrically connected to one of said end surface electrodes.

5. A piezoelectric type electroacoustic transducer according to Claim 1, wherein the piezoelectric vibrating plate has a substantially square shape, and the supporting portions of the box are provided in four positions in the inner peripheral portion of the box so as to support four corners of the piezoelectric vibrating plate.

6. A piezoelectric type electroacoustic transducer according to Claim 1, wherein said protecting films are made of a paste resin which is coated on the piezoelectric vibrating plate.

7. A piezoelectric type electroacoustic transducer according to Claim 1, wherein said protecting films include cuts at corners of the piezoelectric vibrating plate so as to expose the main surface electrodes.

8. A piezoelectric type electroacoustic transducer according to Claim 1, wherein the box includes stands provided in the vicinities of the supporting portions, said stands being arranged so as to be lower than upper surfaces of the supporting portions such that gaps are provided between upper surfaces of the stands and the back side surface of the piezoelectric vibrating plate.

9. A piezoelectric type electroacoustic transducer according to Claim 8, wherein an elastic adhesive is provided between the stands and the back side surface of the piezoelectric vibrating plate.

10. A piezoelectric type electroacoustic transducer according to Claim 1, wherein grooves are provided between a periphery of a bottom wall of the box, and a second adhesive is provided in the grooves.

11. A piezoelectric type electroacoustic transducer comprising:  
a piezoelectric vibrating plate including a plurality of piezoelectric ceramic layers laminated to each other with an internal electrode being interposed between each of the plurality of piezoelectric ceramic layers, and main surface electrodes provided on front and back side main surfaces of the piezoelectric vibrating plate, whereby the piezoelectric vibrating plate is surface-flexural-vibrated in the thickness direction thereof with an AC signal applied between the main surface electrodes and the internal electrode; and

a box including supporting portions on which the outer peripheral portions on the back side of the piezoelectric vibrating plate is supported; wherein  
the piezoelectric vibrating plate is warped on the front-side thereof.

12. A piezoelectric type electroacoustic transducer according to Claim 11, wherein the piezoelectric vibrating plate includes a protecting film provided on substantially the entire back side surface of the piezoelectric vibrating plate, or protecting films provided on substantially the entire front and back side surfaces of the piezoelectric vibrating plate.

13. A piezoelectric type electroacoustic transducer according to Claim 12, wherein the protecting films are provided on both of the front and back side surfaces of the piezoelectric vibrating plate, and the protecting film on the back side surface has thickness that is greater than the protecting film on the front side surface.

14. A piezoelectric type electroacoustic transducer according to Claim 11, wherein the piezoelectric vibrating plate has a substantially rectangular shape, and the supporting portions of the box are provided in four positions in the inner peripheral portion of the box so as to support four corners of the piezoelectric vibrating plate.

15. A piezoelectric type electroacoustic transducer according to Claim 11, wherein the piezoelectric vibrating plate has a substantially square shape, and the

supporting portions of the box are provided in four positions in the inner peripheral portion of the box so as to support four corners of the piezoelectric vibrating plate.

16. A piezoelectric type electroacoustic transducer according to Claim 12, wherein said protecting films are made of a paste resin which is coated on the piezoelectric vibrating plate.

17. A piezoelectric type electroacoustic transducer according to Claim 12, wherein said protecting films include cuts at corners of the piezoelectric vibrating plate so as to expose the main surface electrodes.

18. A piezoelectric type electroacoustic transducer according to Claim 11, wherein the box includes stands provided in the vicinities of the supporting portions, said stands being arranged so as to be lower than upper surfaces of the supporting portions such that desired gaps are provided between upper surfaces of the stands and the back side surface of the piezoelectric vibrating plate.

19. A piezoelectric type electroacoustic transducer according to Claim 18, wherein an elastic adhesive is provided between the stands and the back side surface of the piezoelectric vibrating plate.

20. A piezoelectric type electroacoustic transducer according to Claim 11, wherein grooves are provided between a periphery of a bottom wall of the box, and a second adhesive is provided in the grooves.